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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/040,326	01/03/2002	Fangli Hao	LAM1P132C1	3569

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BEYER WEAVER & THOMAS LLP
P.O. BOX 778
BERKELEY, CA 94704-0778

EXAMINER	
ALEJANDRO MULERO, LUZ L	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 04/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

AS

Office Action Summary	Application No.	Applicant(s)	
	10/040,326	HAO ET AL.	
	Examiner	Art Unit	
	Luz L. Alejandro	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *22-59* is/are pending in the application.

4a) Of the above claim(s) *24,38,40 and 59* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *22,23,25-37,39 and 41-58* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01/03/02* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *0102*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election with traverse of species A and D, claims 22-23, 25-37, 39, and 41-58 in Paper filed 1/20/04 is acknowledged. The traversal is on the ground(s) that there is no serious burden place upon the examiner. This is not found persuasive because as stated in the restriction requirement the species are patentably distinct and search and examination of these patentably distinct species will place burden on the examiner.

The requirement is still deemed proper and is therefore made FINAL.

Claims 24, 38, 40 and 59 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being no allowable generic or linking claim.

Drawings

Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 48-52, 54, and 56-58 are rejected under 35 U.S.C. 102(b) as being anticipated by Ohmi et al., WO 98/39500.

Ohmi et al. shows the invention as claimed including a uniformity mechanism suitable for use in a process chamber within which a plasma is ignited and sustained for processing a substrate 108, the uniformity mechanism comprising: a first zone 101a configured to be disposed below a first region of the substrate, the first zone having a first impedance when energy is coupled therethrough (through, first component, electrode 101); a second zone (the outer periphery of zone 101a which is the part of electrode 101 that is not in contact with the substrate) configured to be disposed below a second region of the substrate (note that below means in a lower place than, therefore, as broadly claimed the part of electrode 101 that is not in contact with the substrate, the periphery of zone 101a, is considered to be below the substrate), the second zone having a second impedance when energy is coupled therethrough (second componenet, edge ring 103), the second impedance being different than the first impedance; and an impedance matching layer 104 having characteristics configured to adjust the second impedance, the characteristics including at least one of a thickness, a length, position, or a material property, and wherein the impedance matching layer is

disposed below the second component (see, for example, figs. 1, 6A, 6B, 7B, 9, 26A-26I, and their descriptions). With respect to claim 54, note that the uniformity mechanism includes a third component 105 for generating an electric field.

Claims 22-23, 25-31, 34-37, 39, 41-45, and 47-58 are rejected under 35 U.S.C. 102(b) as being anticipated by Masuda et al., U.S. Patent 6,171,438.

Masuda et al. shows the invention substantially as claimed including a pedestal for supporting a substrate W during plasma processing, the pedestal comprising: an electrode 130 configured generating an electric field; a chuck 131 disposed above the electrode, the chuck being configured for holding the substrate and having an outer periphery that is smaller than an outer periphery of the substrate (see fig. 2); an edge ring 132 disposed above the electrode, the edge ring being configured for shielding the electrode and the chuck, and including a first portion configured to be disposed between the electrode and the substrate when the substrate is held by the chuck (and configured to surround an outer edge of the chuck) and a second portion being configured to surround an outer edge of the substrate when the substrate is held by the chuck for processing whereby the edge ring cooperated with the chuck to form a recessed portion for accepting the substrate for processing (see fig. 2); and an impedance matching layer 133 disposed between the electrode and the edge ring, the impedance matching layer made of a dielectric material such as alumina. It should be noted that the impedance matching layer 133 will control the impedance between the electrode and the plasma

and will reduce the variations of the electric field. For a complete description, see for example, figs. 1-2 and their descriptions).

With respect to claim 34, note that the chuck is disposed in an inner region of the electrode, the edge ring is disposed above the outer region of the electrode and positioned next to a side of the chuck, and the impedance matching layer is disposed between the edge ring and the electrode and above the outer region of the electrode.

Regarding claims 36-37 and 41, note that the impedance matching layer is bonded to both the edge ring and the electrode, the electrode has an outer periphery that is greater than the outer periphery of the substrate when the substrate is disposed on the chuck for processing.

Regarding claims 44-45, note that Masuda et al. discloses such heat transfer system (see fig. 2 and its description). Concerning claims 49, 53 and 54-55, note that the first component is the chuck, the second component is the edge ring, and the third component is the electrode.

Claims 22-23, 25-31, 34-37, 39, 41-43, and 47-58 are rejected under 35 U.S.C. 102(b) as being anticipated by Wicker et al., U.S. Patent 6,129,808.

Wicker et al. shows the invention substantially as claimed including a pedestal for supporting a substrate 104 during plasma processing, the pedestal comprising: an electrode 108 configured generating an electric field; a chuck 106 disposed above the electrode, the chuck being configured for holding the substrate and having an outer periphery that is smaller than an outer periphery of the substrate (see fig. 2); an edge

ring 114 disposed above the electrode, the edge ring being configured for shielding the electrode and the chuck, and including a first portion configured to be disposed between the electrode and the substrate when the substrate is held by the chuck (and configured to surround an outer edge of the chuck) and a second portion being configured to surround an outer edge of the substrate when the substrate is held by the chuck for processing whereby the edge ring cooperated with the chuck to form a recessed portion for accepting the substrate for processing (see fig. 1); and an impedance matching layer 112 disposed between the electrode and the edge ring, the impedance matching layer made of a dielectric material such as SiC. It should be noted that the impedance matching layer 112 will control the impedance between the electrode and the plasma and will reduce the variations of the electric field. For a complete description, see for example, fig. 1 and its description).

With respect to claim 34, note that the chuck is disposed in an inner region of the electrode, the edge ring is disposed above the outer region of the electrode and positioned next to a side of the chuck, and the impedance matching layer is disposed between the edge ring and the electrode and above the outer region of the electrode.

Regarding claims 36-37 and 41, note that the impedance matching layer is bonded to both the edge ring and the electrode, the electrode has an outer periphery that is greater than the outer periphery of the substrate when the substrate is disposed on the chuck for processing.

Concerning claims 49, 53 and 54-55, note that the first component is the chuck, the second component is the edge ring, and the third component is the electrode.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 22-23, 25-37, 39, 41-43, and 46-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tamura et al., U.S. Patent 5,792,304 in view of Ohmi et al., WO 98/39500.

Tamura et al. shows the invention substantially as claimed including a pedestal for supporting a substrate 1 during plasma processing, the pedestal comprising: an electrode 2 configured generating an electric field (see, for example, fig. 9 and col. 14, line 44-52); a chuck disposed above the electrode, the chuck being configured for holding the substrate and having an outer periphery that is smaller than an outer

periphery of the substrate (see, for example, fig. 9 and col. 14, line 44-52); an edge ring 36 disposed above the electrode, the edge ring being configured for shielding the electrode and the chuck, and including a first portion configured to be disposed between the electrode and the substrate when the substrate is held by the chuck (and configured to surround an outer edge of the chuck) and a second portion being configured to surround an outer edge of the substrate when the substrate is held by the chuck for processing whereby the edge ring cooperated with the chuck to form a recessed portion for accepting the substrate for processing. For a complete description, see for example, fig. 9 and its description).

Tamura et al. does not expressly disclose the claimed impedance matching layer disposed between the electrode an the edge ring. Ohmi et al. discloses an apparatus comprising a pedestal for supporting a substrate 108 during plasma processing, the pedestal including an impedance matching layer 104 disposed between an electrode 101 and an edge ring 103, the impedance matching layer made of a dielectric material and has characteristics configured for controlling an impedance between the electrode and a plasma in order to improve the processing uniformity across the surface of the substrate (see, for example, figs. 1, 6A, 6B, 7B, 9, 26A-26I, and their descriptions). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the pedestal of the Tamura et al. as to comprise an impedance matching layer disposed between the electrode and the edge ring, as taught by Ohmi et al., in order to improve the processing uniformity across the surface of the substrate and thereby optimizing the apparatus.

With respect to claims 23, 25, 27, the impedance matching layer of the apparatus of Tamura et al. modified by Ohmi et al., will reduce variations in the electric field, is arranged to control the impedance between the electrode and the plasma at the edge of the substrate, is configured to be disposed between the electrode and the substrate when the substrate is held by the chuck. Regarding claim 32, the chuck, edge ring and impedance matching layer are formed from a dielectric material, wherein the dielectric constant of the edge ring may be equal to the dielectric constant of the chuck (note that both the chuck and the edge ring can be made of Al2O3), and wherein the dielectric constant of the impedance matching layer may be different than the dielectric constant of the edge ring and the chuck. Furthermore and with respect to claim 33, it should be noted that a first impedance produced through the chuck is different than a second impedance produced through the edge ring, and wherein the impedance matching layer may be arranged to adjust the second impedance produce through the edge ring so that the second impedance is substantially equal to the first impedance produced through the chuck.

With respect to claim 34, note that the chuck is disposed in an inner region of the electrode, the edge ring is disposed above the outer region of the electrode and positioned next to a side of the chuck, and the impedance matching layer is disposed between the edge ring and the electrode and above the outer region of the electrode.

Regarding claims 36-37 and 41, note that the impedance matching layer of the apparatus of Tamura et al. modified by Ohmi et al., is bonded to both the edge ring and the electrode by screw 112, the electrode has an outer periphery that is greater than the

outer periphery of the substrate when the substrate is disposed on the chuck for processing.

Regarding claims 49, 53 and 54-55, note in the pedestal of Tamura et al. modified by Ohmi et al., the first component is the chuck, the second component is the edge ring, and the third component is the electrode.

Claims 44-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tamura et al., U.S. Patent 5,792,304 in view of Ohmi et al., WO 98/39500 as applied to claims 22-23, 25-37, 39, 41-43, and 46-58 above, and further in view of Masuda et al., U.S. Patent 6,171,438.

Tamura et al. and Ohmi et al. are applied as above but do not expressly disclose a heat transfer system as claimed. Masuda et al. discloses a plasma processing apparatus comprising a pedestal including a heat transfer system for controlling the temperature of the substrate and the edge ring during processing, the heat transfer system including a first channel extending through the electrode to the interface between the chuck and the substrate, and a second channel extending through the electrode to the interface between the electrode and the edge ring, the heat transfer system being configured to provide a heat transfer medium though the channels, wherein the heat transfer is a helium gas (see fig. 2 and its description). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Tamura et al. modified by Ohmi et al. as to comprise the heat transfer system disclosed by Masuda et al. because

this allows for effective and efficient temperature control of the substrate and the edge ring without incorporating a complicated mechanism.

Claims 32-33 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masuda et al., U.S. Patent 6,171,438.

Masuda et al. is applied as above and further discloses that the chuck, the edge ring and the impedance matching layer are made of a dielectric material, but does not expressly disclose that the dielectric constant of the edge ring is equal to the dielectric constant of the chuck, wherein the dielectric constant of the impedance matching layer is different than the dielectric constant of the edge ring and the chuck, and wherein the impedance matching layer is arranged to adjust an impedance produced through the edge ring so that it is substantially the same impedance as an impedance produced through the chuck. However, it would have been an obvious choice of design to one having ordinary skill in the art at the time the invention was made to choose the same or different materials for the chuck, the edge ring and the impedance matching layer based upon a variety of factors, including for example, the plasma resistance of the material, and such limitation would not lend patentability to the instant invention absent the showing of unexpected results.

Claims 32-33 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wicker et al., U.S. Patent 6,129,808.

Wicker et al. is applied as above and further discloses that the chuck, the edge ring and the impedance matching layer are made of a dielectric material, but does not expressly disclose that the dielectric constant of the edge ring is equal to the dielectric constant of the chuck, wherein the dielectric constant of the impedance matching layer is different than the dielectric constant of the edge ring and the chuck, and wherein the impedance matching layer is arranged to adjust an impedance produced through the edge ring so that it is substantially the same impedance as an impedance produced through the chuck. However, it would have been an obvious choice of design to one having ordinary skill in the art at the time the invention was made to choose the same or different materials for the chuck, the edge ring and the impedance matching layer based upon a variety of factors, including for example, the plasma resistance of the material, and such limitation would not lend patentability to the instant invention absent the showing of unexpected results.

Claims 44-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wicker et al., U.S. Patent 6,129,808 in view of Masuda et al., U.S. Patent 6,171,438.

Wicker et al. is applied as above but does not expressly disclose a heat transfer system as claimed. Masuda et al. discloses a plasma processing apparatus comprising a pedestal including a heat transfer system for controlling the temperature of the substrate and the edge ring during processing, the heat transfer system including a first channel extending through the electrode to the interface between the chuck and the substrate, and a second channel extending through the electrode to the interface

between the electrode and the edge ring, the heat transfer system being configured to provide a heat transfer medium though the channels, wherein the heat transfer is a helium gas (see fig. 2 and its description). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Wicker et al., as to comprise the heat transfer system disclosed by Masuda et al. because this allows for effective and efficient temperature control of the substrate and the edge ring without incorporating a complicated mechanism.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Ohmi et al., U.S. Patent 6,585,851 is an English equivalent of WO 98/39500.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 571-272-1430. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory L. Mills can be reached on 571-272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Luz L. Alejandro
Primary Examiner
Art Unit 1763

April 19, 2004